

TITLE: TREATMENT FOR IMPROVING CELLULOSE INSULATION

TECHNICAL FIELD

This invention relates generally to cellulose insulation of the type utilizing a shredded newspaper base which is treated with a fire retardant chemical composition and used for the thermal insulation of homes and other building structures. More particularly, the invention relates to the addition of a specific range of antistat and electrostatically positively charged fibrous materials to the newspaper base which will lower density and reduce settling of the insulation.

BACKGROUND ART

The manufacture of cellulosic insulation, in accordance with the present state of the art, begins with a grinding operation in which newspapers are shredded to a level of

approximately 1" x 1" pieces and individual fibers. These fibers and paper pieces, carried in air stream, are then ground in a second operation in which finely ground fire retardant chemical is added to the paper and paper pieces.

The key to the understanding of the underlying basis of cellulose insulation is to recognize that cellulose insulation is made up of newspaper pieces and fibers which are affected by static electricity. Like elements will repel; unlike elements will attract. A method of determining the electrostatic charge of a material piece or fiber is to rub the flat side of a nylon toothbrush about 50 times on a piece of wool. Then attempt to attract the material in question with the flat side of the toothbrush. If the material is positively charged, it will attach to the flat part of the toothbrush. If the material is negatively charged, it will not be attracted. Based on the above system, the face of a newsprint paper piece is positively charged and the edge fibers are negatively charged. The newspaper separate fibers are also negatively charged.

U.S. Patent 4468336 refers to an insulation "wherein the loose fill cellulose insulation has a settled density on the order of about 2.5 pounds per cubic foot before mixing with staple fibers, and the mixture of cellulosic insulation with from 2% to 25% by weight staple fibers has a settled density in the order from 2.1 pounds per cubic foot to about 1.1 pounds per cubic foot. Staple fibers were defined as

acrylic, polypropylene, acetate etc. These fibers are electrostatically positively charged.

Because the paper pieces were positively charged, the surface of the paper piece attracted negatively charged paper fibers, essentially parallel to the face of the paper piece. This attraction caused the paper piece to become neutrally charged and therefore, no longer statically attractive. Therefore, the positively charged staple fibers attracted most of the remainder of negatively charged paper fibers, forming a phase separate from the paper pieces. This separate phase is not settling stable because this structure is not supported by the paper pieces and will condense. It took a large amount of the staple fibers to lower the cellulose density by producing a separate, lower density, paper fiber to positively charged fiber structure.

BRIEF DESCRIPTION OF INVENTION

In an attempt to improve settling and density of cellulose insulation, I determined that there was an advantage to produce a specific type of fiber-paper piece structure. In this structure, use of the limestone-antistat mixture as described in U.S. Patents 5399375 and 5455065, in a narrow dosage range, reduces the static charge on the paper pieces and fibers to a level where fire retardant chemical will adhere to both the paper pieces and fibers. The preferred structure is where the fibers are attached to the

paper piece at an angle to the face of the paper piece, not parallel to the face of the paper piece. In this preferred structure, there is very little separate fiber to fiber groupings.

Electrostatically positively charged fibers such as wood, fiberglass or polyester, added either before or after the addition of the antistat to the partially ground paper, are attracted to the negative edges of the electrostatically charged paper piece. The attached positively charged fibers then attract the negatively charged paper fibers, producing a reinforced structure which reduces density and settling.

These improvements in density and settling result from the fact that the negative fibers are deposited at an angle to the face of the paper piece. The amount of electrostatically positively charged fibers added will vary with the type of fiber used. The key is that the amount of separate, positively charged fibers to negatively charged fiber groupings is held to a minimum.

The following convention will be used. Newspaper pieces, wood fibers, cardboard fibers, fiberglass fibers and polyester fibers are positively charged. Newspaper fibers and cardboard pieces are negatively charged. The relationship of the positively charged fibers to the negatively charged paper fibers can only be understood by using a high powered microscope.

DETAILED DESCRIPTION

The amount of wood fiber necessary to reinforce the paper piece/paper fiber structure is in the range of 2% to 8% of the weight of the paper and positive electrostatic fiber input. The amount of fiberglass fiber and polyester fiber to reinforce the settling stable structure is in the range of 0.5% to 2% of the paper and positive electrostatic fiber input. The preferred amount of electrostatic positively charged reinforcing fibers is determined by the structure achieved, as seen using a high powered microscope.

The anti-static constituent of the precoat mixture of antistat and finely ground limestone is preferably on the order of 0.001% to 0.002% by weight of the paper and positive electrostatic fiber input. The limestone component range is 1% to 2% of the weight of paper and positive electrostatic fiber input. Other fine ground additives may be used in place of the limestone, but fire retardancy will be decreased. This range of antistat reduces the static charges of the paper pieces, paper fibers and electrostatically positively charged fibers so that positively charged fine ground fire retardant chemicals will adhere to the paper pieces, paper fibers and electrostatically positively charged fibers.

In this range, the fibers will attach, essentially at an angle to the paper pieces, causing a greater distance between paper pieces and a lower density. Antistat levels

above this range will reduce the static charges so that the attachment of fibers to the paper pieces will be diminished and paper fiber to electrostatically positive fiber groupings will occur, reducing the settling stability effect. Antistat levels below this range will tend to inhibit the attachment of fire retardant chemical to the paper pieces, reducing fire retardancy.

Example 1.

A trial was made using 95% newspaper and 5% sawdust. The newspaper was ground in a shredder to a size of about 1"x1". A precoat mixture was then added to the shredded newspaper, the precoat containing dimethyl distearyl ammonium chloride in the amount of 0.0015%, combined with limestone in the amount of 1.5% of the weight of paper and positive electrostatic fiber input. Sawdust in the amount of 5% of the weight of paper and positive electrostatic fiber input was then added. These materials were fed in an air stream into a finish mill along with 10% of a finely ground fire retardant chemical, based on the total weight of the system.

The initial material had a density of 0.70 lbs./cu.ft. This material was placed in a 12" x 12" x 6" high cardboard box in an atmosphere of 50% relative humidity and 70 degrees F for a period of one month. Settling was 8% after one month.

Commercial cellulose, not containing the sawdust or

antistat, under the same conditions as above, had an initial density of 1.3 lbs./cu.ft and settled 16% over the same period.

Example 2

A trial was made similar to Example 1 but the sawdust was first combined with the newspaper base before the addition of the limestone antistat mixture. Under conditions similar to Example 1, settling after 30 days was 12% after one month and initial density was 0.80 lbs./cu.ft.

Example 3

A trial was made similar to Example 1 but 2% fiberglass was substituted for the sawdust used in Example 1. Under conditions similar to Example 1, settling after 30 days was 7% and density was 0.75 lbs./cu.ft.

Example 4

A trial was made similar to Example 2 but 2% fiberglass was substituted for the sawdust used in Example 2. Under conditions similar to example 2, settling was 9% and density was 0.81 lbs./cu.ft.

Example 5

A trial was made similar to Example 1 but 1% polyester fibers were substituted for the sawdust used in Example 1.

Example 6

A trial was made similar to Example 2 but 1% polyester fibers were substituted for the sawdust used in Example 2. Under conditions similar to Example 2, settling after 30 days was 12% and density was 0.87 lbs./cu.ft.